JP 2000-009027

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention applies and is effective in the actuator driven by the hydrostatic pressure about the electromagnetic pump which generates a hydrostatic pressure.
[0002]
[Description of the Prior Art] For example, the pump mechanism of the plunger type which carries out the inhalation regurgitation of the fluid to JP,9-126122,A by making a plunger go like a publication is known.
[0003]
[Problem(s) to be Solved by the Invention] By the way, since the solenoid valve which controls a fluid flow is also needed in addition to the electromagnetic pump which generates a hydrostatic pressure in order to control the actuator driven by the hydrostatic pressure, the whole equipment containing an actuator is enlarged and there is a problem that the manufacturing cost of equipment will rise.
[0004] this invention aims at aiming at the miniaturization and manufacturing cost reduction containing the device which works by hydrostatic pressures, such as an actuator, of the whole equipment in view of the point describing above.
[0005]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, the following technical means are used for this invention. One plunger displaced with the electromagnetic force which a solenoid coil (101) and a solenoid coil (101) generate in invention according to claim 1 to 6 (103), The pump mechanism of the plunger type which carries out the inhalation regurgitation of the fluid with reciprocating movement of a plunger (103) (110), It is characterized by having the valve system (120) driven with reciprocating movement of a plunger (103), and housing (104) which contains a solenoid coil (101), a pump mechanism (110), and a valve system (120). [0006] Thereby, since the pump mechanism (110) and the valve system (120) are unified, the miniaturization (lightweight-izing) and manufacturing cost reduction containing the device which works by the hydrostatic pressure of the whole equipment can be aimed at. In addition, you may supply a hydrostatic pressure to the actuator (250) of screw dregs heater equipment in an invention profit according to claim 7, a claim 1, or the solenoid-valve one apparatus electromagnetic pump (100) of any one publication of six.
[0007] The elastic member which carries out elastic deformation with the variation rate of a piston member (402) and a piston member (402) in invention according to claim 8 (409), When the aforementioned piston member (402) is held in a predetermined position against the elastic force of an elastic member (409), It has the piston control section (410) changed to the case where displacement of a piston member (402) is enabled. a piston control section (410) In the state where a piston member (402) can be displaced, an elastic force is characterized by holding the aforementioned piston member (402) in the position which becomes large from the position which the sense of the variation rate of a piston member (402) reverses.
[0008] Since the device which abolishes a valve system and works by the hydrostatic pressure is controllable by this to mention later, the miniaturization (lightweight-izing) and manufacturing cost reduction containing this device of the whole equipment can be aimed at. Incidentally, the sign in the parenthesis of each above-mentioned means is an example which shows a correspondence relation with the concrete means of a publication to the operation gestalt mentioned later.
[0009]
[Embodiments of the Invention] (The 1st operation gestalt) This operation gestalt applies the solenoid-valve one apparatus electromagnetic pump (it abbreviates to a pump hereafter.) 100 concerning this invention to the screw dregs heater equipment for vehicles, and drawing 1 is the ** type view of screw dregs heater equipment. 200 are a screw dregs heater made to generate heat by rotating Rota 210 disc-like within viscous fluid (this operation gestalt silicone oil) among drawing 1 , and 220 is a shaft which carries out the rotation drive of Rota 210. In addition, with this operation gestalt, through a pulley 230 and a V belt (not shown), a shaft 220 obtains driving force from the run engine for vehicles (not shown), and is rotated.
[0010] And the heat generated at the screw dregs heater 200 is emitted to the vehicle interior of a room from the heater core (not shown) arranged in the vehicle interior of a room through the engine cooling water which circulates the cooling water path 240 formed in the screw dregs heater 200. Moreover, 250 is a piston (actuator) which adjusts the calorific value of the screw dregs heater 200 by changing the volume of the exoergic room 260 where viscous fluid was enclosed, and this piston 250 is driven with the oil pressure (hydrostatic pressure) supplied from a pump 100.
[0011] In addition, on both sides of a piston 250, the exoergic room 260 and the back room 251 formed in the opposite side are open for free passage to the low-tension side (tank section 300 of a hydraulic oil) via the valve system 120 of the pump

100 mentioned later. Next, a pump 100 is described using drawing 2 . 101 is a solenoid coil (magnetic field generating means) which generates electromagnetic force (magnetic field), and 102 is the winding frame (bobbin) of the solenoid coil 101 which consists of non-magnetic materials, such as a resin. And in the solenoid coil (it abbreviates to a coil hereafter.) 101, the plunger 103 is arranged by the longitudinal direction possible [reciprocating movement], and this plunger 103 is products made from a magnetic material, such as iron.

[0012] 104a is middle housing (yoke housing) which constitutes the magnetic path of the magnetic flux by which induction was both carried out to if a coil 101 and a plunger 103 are contained with the coil 101, names generically this middle housing 104a, front housing 104b, and rear housing 104c mentioned later, and calls it housing 104. In addition, middle housing 104a is products made from a magnetic material, such as iron.

[0013] And a plunger 103 moves to a longitudinal direction other end side (rear housing 104c side) by coil spring (elastic member) 103a, when it moves to the longitudinal direction end side (front housing 104b side) of a plunger 103 according to the amount of energization when it energizes in a coil 101, and the energization to a coil 101 is intercepted.

[0014] Moreover, 104c is rear housing with which the valve system 120 which has the valve element 121 which opens and closes the fluid channel 310 (refer to drawing 1) from the back room 251 to the tank section 300 was contained, 122 is a high-pressure port which is open for free passage in the back room 251, and 123 is a low voltage port which is open for free passage in the tank section 300. By the way, among middle housing 104a, the pump mechanism 110 of the plunger type which carries out the inhalation regurgitation of the hydraulic oil (fluid) to the front housing 104b side with reciprocating movement of a plunger 103 is contained, 111 is an inhalation port which is open for free passage in the tank section 300, and 112 is a regurgitation port which carries out the regurgitation of the hydraulic oil.

[0015] And as shown in (a) of drawing 3 , the pump mechanism 110 is pressed fit in the longitudinal direction end side (refer to drawing 2) of a plunger 103, and consists of operation rooms P formed of a plunger 103, the piston section 113 which moves reciprocately in one, the piston section 113, and the cylinder 114. 1st free passage way 113a which makes the inhalation port 111 and the operation room P open for free passage is specifically formed in the piston section 113, and the 1st valve element 115 which can slide is arranged to 1st free passage way 113a (piston section 113) in this 1st free passage way 113a. And stoma 115a which has the cross section smaller than the path cross section of 1st free passage way 113a is formed in the 1st valve element 115.

[0016] In addition, 115b is the snap ring to which the 1st valve element 115 prevents dropping out of the inside of 1st free passage way 113a, and pressing fixation of this snap ring 115b is carried out at the piston section 113. Moreover, 116 is the 2nd valve element which opens and closes path 112a which makes the operation room P and regurgitation port 112 side open for free passage, and this 2nd valve element 116 is pressed by the sense which closes path 112a by the elastic force of a coil spring (elastic member) 117.

[0017] On the other hand, as shown in (a) of drawing 4 , a valve system 120 has the valve element 121 which opens and closes the free passage way 124 which reaches the low voltage port 123, and the coil spring (elastic member) 125 which makes the elastic force of the sense which closes the free passage way 124 act on a valve element 121, and consists of high-pressure ports 122. And while not energizing to a coil 101 (at the time of un-energizing), a valve element 121 is pressed by the sense which the free passage way 124 opens by height 103b formed in the longitudinal direction other end side of a plunger 103.

[0018] Next, the operation of a pump 100 is described.

1. At the time of un-energizing, at the time of un-energizing, since electromagnetic force does not occur, the plunger 103 has displaced and stopped to the longitudinal direction other end side by the elastic force of coil spring 103a. For this reason, as shown in (a) of drawing 4 , a valve system 120 (free passage way 124) will be in the state where it opened, and the pump mechanism 110 will be in the state where it stopped.

[0019] 2. If it energizes in a coil 101 at the time of energization, with electromagnetic force, a plunger 103 will overcome the elastic force of coil spring 103a, and will move to the longitudinal direction end side. For this reason, in order that height 103b of a plunger 103 may separate from a valve element 121, as shown in (b) of drawing 4 , a valve system 120 (free passage way 124) will be in the state where it closed.

[0020] And if the voltage impressed to a coil 101 is changed periodically and the magnetomotive force of a coil 101 is periodically changed in the state where it energized in the coil 101, by the balance with the electromagnetic force and the elastic force which act on a plunger 103, a plunger 103 will be interlocked with change of magnetomotive force, and will move reciprocately. That is, when magnetomotive force is large (with this operation gestalt) When applied voltage is set to 12V and magnetomotive force [from] is small (with this operation gestalt) If it is made to change when applied voltage is set to 5V, since a plunger 103 moves to the sense which the volume of the operation room P expands by the elastic force of coil spring 103a ((a) of (c) -> drawing 3 of drawing 3), a hydraulic oil will be inhaled in the operation room P from the inhalation port 111.

[0021] In addition, at this time, as shown in (a) of drawing 3 (when the volume of the operation room P is expanded) By the pressure loss at the time of a hydraulic oil circulating stoma 115a of the 1st valve element 115, since the pressure by the side of the operation room P becomes lower than the pressure of an opposite side (plunger 103 side) from the 1st valve element 115, although the 1st valve element 115 tends to move to the operation room P side and it is going to blockade hole 115c of snap ring 115b Since space 115e is formed between the snap ring 115 and the 1st valve element 115 of 115d of heights of the shape of a ring prepared in the periphery section of snap ring 115b, the free passage state of stoma 115a and hole 115c is secured.

[0022] Since the pressure in the operation room P rises, the 2nd valve element 116 moves to the regurgitation port 112 side, since a plunger 103 will move to the sense which the volume of the operation room P reduces with electromagnetic force on the other hand ((c) of (b) -> drawing 3 of (a) -> drawing 3 of drawing 3), if it is made to change from from when magnetomotive force is small when magnetomotive force is large, and path 112a opens, a hydraulic oil is breathed out.
[0023] in addition, in the initial stage at this time (when the volume of the operation room P contracts) Although the 1st valve element 115 is located in the operation room P side and 1st free passage way 115a is open as shown in (a) of drawing 3 Since the pressure by the side of the operation room P becomes higher than the pressure of an opposite side (plunger 103 side) from the 1st valve element 115 as the volume of the operation room P contracts, Since the 1st valve element 115 moves to a plunger 103 side and closes 1st free passage way 115a as shown in (b) of drawing 3 , the regurgitation of the hydraulic oil can be certainly carried out from the regurgitation port 112.
[0024] As stated above, the valve system 120 is opened [at the time of energization, / the plunger 103 was made to move reciprocately, and the pump mechanism 110 was driven and] with this operation gestalt, and closed by changing an energization state and the state where it does not energize by changing magnetomotive force periodically (refer to drawing 5). Next, the outline operation of screw dregs heater equipment is described.
[0025] 1. When Making it Generate Heat at Screw Dregs Heater 200 (Refer to Drawing 6)
While working the pump mechanism 110, the back room 251 is expanded and the volume of the exoergic room 260 is made to reduce by closing a valve system 120. Since the exoergic room 260 of the range from the center side of Rota 210 to the method side of the outside of a path is full of viscous fluid while the volume of the gas (foam) mixed in viscous fluid contracts by this, and the gases in the exoergic room 260 gather to the center side of Rota 210, heat occurs according to rotation of Rota 210.
[0026] In addition, since peripheral speed hardly participates [in the center side of Rota 210] in generation of heat originally for a low reason, even if gases gather to a center side, there is almost no influence in the calorific value of the screw dregs heater 200.
2. When Generation of Heat at Screw Dregs Heater 100 is Stopped (Refer to Drawing 1)
While stopping the pump mechanism 110, the back room 251 is made to reduce and the volume of the exoergic room 260 is made to expand by opening a valve system 120.
[0027] Since a foam spreads in the method side of the outside of a path of Rota 210 while volume of the gas (foam) which had gathered to the center side of Rota 210 is expanded by this (expansion), generation of heat at the screw dregs heater 200 stops substantially. Next, the feature of this operation gestalt is described. Since both the mechanisms 110 and 120 of both are driven with one plunger 103 while according to this operation gestalt containing the pump mechanism 110 and a valve system 120 and unifying both the mechanisms 110 and 120 in housing 104, a miniaturization (lightweight-izing) and manufacturing cost reduction of the whole screw dregs heater equipment can be aimed at.
[0028] (The 2nd operation gestalt) This operation gestalt is written (less or equal [the regurgitation port 112 and the high-pressure port 122 in the pump 100 concerning the 1st operation gestalt], and it writes with common use-ized ** the high-pressure port [this common-use-ized port] 122.) and a valve system 120 are constituted in the pump mechanism 110 side.
[0029] That is, with this operation gestalt, as shown in drawing 7 , while forming the high-pressure port 122 and the low voltage port 123 in the movement direction of the piston section 113 (plunger 103), and the direction which intersects perpendicularly, the cam section 130 which projects towards the method side of the outside of the path in the nose-of-cam side (regurgitation port 112 side) of the piston section 113 is formed. and the high-pressure-valve object 131 which opens and closes each ports 122 and 123 and the low voltage valve element 132 -- the coil springs (elastic member) 133 and 134 which generate the elastic force (this elastic force is hereafter called valve-closing force.) of the sense which is alike, respectively, receives and closes each ports 122 and 123 are arranged At this time, both the coil springs 133 and 134 are set up so that the elastic force which acts on the high-pressure-valve object 131 may become smaller than the elastic force which acts on the low voltage valve element 132.
[0030] Incidentally, both the coil springs 133 and 134 serve also as the press member which presses both the valve elements 131 and 132 in the cam section 130. Moreover, 135 is a suction valve portion (check valve) of a lead valvate opened only when a hydraulic oil flows in the operation room P from the inhalation port 111. Next, the operation of the pump 100 concerning this operation gestalt is described.
[0031] 1. At the time of un-energizing, in the time of un-energizing, the plunger 103 is located in the position which both the valve elements 131 and 132 contact at the peak of the cam section 130 while the operation room P becomes the largest by the elastic force of coil spring 103a, as shown in drawing 7 . For this reason, while being in the state where the high-pressure port 122 and the low voltage port 123 opened, and the valve system 120 opened, the pump mechanism 110 will be in the state where it stopped.
[0032] 2. Since a plunger 103 will move to the longitudinal direction as shown in drawing 8 and 9 if it energizes at the time of energization, the contact part of both the valve elements 131 and 132 and the cam section 130 moves to the root side of the cam section 130. For this reason, since the volume of the operation room P contracts as shown in drawing 8 when magnetomotive force is enlarged and it will be in the state where the high-pressure port 122 and the low voltage port 123 closed, and the valve system 120 closed, the pressure in the operation room P rises, the small high-pressure port 122 of the valve-closing force opens, and a hydraulic oil is breathed out.
[0033] On the other hand, since it will move to the sense which the volume of the operation room P expands as a plunger 103

shows drawing 9 by the elastic force of coil spring 103a if magnetomotive force becomes small, a hydraulic oil is inhaled in the operation room P from the inhalation port 111. Therefore, the pump mechanism 110 can be worked by changing magnetomotive force periodically like the 1st operation gestalt.

[0034] Next, the feature of this operation gestalt is described. Since a valve system 120 is constituted in the pump mechanism 110 side and both the mechanisms 110 and 120 are unified, a pump 100 can be miniaturized further (lightweight-izing).

(The 3rd operation gestalt) This operation gestalt common-use-izes the low voltage port 123 and the inhalation port 111 to the 2nd operation gestalt (it writes hereafter the low voltage port [this common-use-ized port] 123.).

[0035] That is, with this operation gestalt, as shown in drawing 10 , while unifying the piston section 113 and a plunger 103, the free passage way 140 made to open for free passage from the low voltage port 123 to the operation room P is formed in a plunger 103. And among the free passage ways 140 in a plunger 103, it permits that a hydraulic oil circulates only at the operation room P side from the low voltage port 123 side in the opening 141 by the side of the operation room P, and the check valve 142 of a lead valvate which prevents the thing [that a hydraulic oil flows backwards] from the operation room P side on the contrary at the low voltage port 123 side is arranged.

[0036] Moreover, 143 is a stopper which opening 141 opens and to carry out, when the high-pressure port 122 is open (at the time of un-energizing), after the high-pressure-valve object 131 has contacted the peak of the cam section 130. Next, the operation of the pump 100 concerning this operation gestalt is described.

1. At the time of un-energizing, in the time of un-energizing, since opening 141 and the high-pressure port 122 are open as shown in drawing 10 , a valve system 120 will be in the state where it opened. Moreover, since the plunger 103 has stopped, the pump mechanism 110 has stopped.

[0037] 2. Since a plunger 103 will move to the longitudinal direction as shown in drawing 11 and 12 if it energizes at the time of energization, the contact part of the high-pressure-valve object 131 and the cam section 130 moves to the root side of the cam section 130. For this reason, the high-pressure port 122 closes. Since a plunger 103 moves to the sense which the volume of the operation room P reduces as shown in drawing 11 when increasing magnetomotive force at this time, the pressure in the operation room P rises. And since opening 141 is closed with the check valve 142, the hydraulic oil in the operation room P which lost the place to go to overcomes the valve-closing force of a coil spring 134, pushes the high-pressure-valve object 131 open, and is breathed out from the high-pressure port 122.

[0038] On the other hand, in order that the pressure in the operation room P may decline and a check valve 142 may open [if magnetomotive force becomes small] while the high-pressure port 122 closes since it moves to the sense which the volume of the operation room P expands as a plunger 103 shows drawing 12 by the elastic force of coil spring 103a, a hydraulic oil is inhaled in the operation room P from the low voltage port 123. Therefore, when changing magnetomotive force periodically, while the pump mechanism 110 works like the 1st operation gestalt, a valve system 120 opens.

[0039] Next, the feature of this operation gestalt is described. Since the low voltage port 123 and the inhalation port 111 are common-use-ized and the number of ports is decreasing, while being able to miniaturize a pump 100 further (lightweight-izing), management of piping linked to a pump 100 can be simplified.

(The 4th operation gestalt) This operation gestalt is the modification of the pump 100 concerning the 2nd operation gestalt.

[0040] Namely, with this operation gestalt, as shown in drawing 13 , while locating the high-pressure port 122 on the extension wire of a plunger 103, the inhalation port 111 is arranged in the direction of a path of a plunger 103. Moreover, the free passage hole 151 which makes the high-pressure-valve object 150 which opens and closes the high-pressure port 122 open the high-pressure port 122 and operation room P side for free passage is formed, and the valve element 152 which opens and closes the free passage hole 151 is arranged between a plunger 103 (piston section 113) and the high-pressure-valve object 150.

[0041] And the valve element 152 and the plunger 103 (piston section 113) are connected by the flexible member (this operation gestalt coil spring) 153 which can be expanded and contracted in the movement direction of a plunger 103. In addition, with this operation gestalt, a valve element 152 is in the state (state where the low voltage valve element 132 touches the peak of the cam section 130) which the low voltage port 123 is opening, and is located in the position which the free passage hole 151 opens.

[0042] Next, the operation of the pump 100 concerning this operation gestalt is described.

1. At the time of un-energizing, in the time of un-energizing, the plunger 103 is located in the position which the low voltage valve element 132 contacts at the peak of the cam section 130 while the operation room P becomes the largest by the elastic force of coil spring 103a so that it may be shown drawing 13.

[0043] For this reason, since the high-pressure port 122 and the low voltage port 123 are open for free passage, while being in the state where the valve system 120 opened, the pump mechanism 110 will be in the state where it stopped.

2. Since Plunger 103 Will Move to the Longitudinal Direction as Shown in Drawing 14 and 15 if it Energizes at the Time of Energization In order that the contact part of the low voltage valve element 132 and the cam section 130 may move to the root side of the cam section 130, when it is the state where the low voltage port 123 closed, and a bird clapper and magnetomotive force is increased As shown in drawing 14 , while a plunger 103 moves to the sense which the volume of the operation room P reduces and the pressure in the operation room P rises, the free passage hole 151 is closed by the valve element 152.

[0044] And if the pressure in the operation room P rises further, since the high-pressure-valve object 150 moves to the sense (space left-hand side) of movement of a plunger 103 with a valve element 152, the high-pressure port 122 will open and the hydraulic oil in the operation room P will be breathed out from the high-pressure port 122. On the other hand, in order that the pressure in the operation room P may decline and a suction valve portion 135 may open [if magnetomotive force becomes

small] while the high-pressure port 122 closes since it moves to the sense which the volume of the operation room P expands as a plunger 103 shows drawing 15 by the elastic force of coil spring 103a, a hydraulic oil is inhaled in the operation room P from the inhalation port 111.

[0045] Therefore, when changing magnetomotive force periodically, while the pump mechanism 110 works like the 1st operation gestalt, a valve system 120 opens.

(The 5th operation gestalt) This operation gestalt makes in agreement the change frequency of magnetomotive force, and the resonant frequency of the plunger 103 determined by a plunger 103 and coil spring 103a in the pump 100 concerning the 1st - the 4th operation gestalt at the time of operation of the pump mechanism 110.

[0046] Thereby, since a plunger 103 resonates with a resonant frequency, while being able to make small magnetomotive force for carrying out the both-way drive of the plunger 103, the direction of movement magnitude more nearly actual than the movement magnitude of the plunger 103 determined by the static balance with electromagnetic force and the elastic force of coil spring 103a becomes large. Therefore, the discharging volume of the pump mechanism 110 can be enlarged, making a coil 101 small. As a result, the miniaturization (lightweight-izing) of a pump 100 can be attained further.

[0047] (The 6th operation gestalt) In case this operation gestalt changes magnetomotive force that a plunger 103 should be constituted from a permanent magnet while performing magnetization processing to a plunger 103, it sets the applied voltage to a coil 101 constant, and it is made to change the polarity of the applied voltage in the pump 100 concerning the 1st - the 5th operation gestalt.

[0048] By the way, in an above-mentioned operation gestalt, since it becomes difficult to set up greatly the difference (for this difference to be hereafter called magnetomotive-force difference.) of the case where magnetomotive force is large, and the case of being small when the maximum of applied voltage is small, the movement magnitude of a plunger 103 and the discharge pressure of the pump mechanism 110 cannot be enlarged. On the other hand, with this operation gestalt, since magnetomotive force is changed by changing the polarity of applied voltage, even if it is the case that the maximum of applied voltage is small, a magnetomotive-force difference can be enlarged. Therefore, even if it is the case that the maximum of applied voltage is small, the movement magnitude of a plunger 103 and the discharge pressure of the pump mechanism 110 can be enlarged.

[0049] (The 7th operation form) Unlike an above-mentioned operation form, this operation form is related with the actuator 400 which abolishes a valve system 120 and drives the piston 250 of the screw dregs heater 200, as shown in drawing 16 . Drawing 17 is the ** type view of the actuator 400 concerning this operation form. And 401 is housing and is arranged possible [reciprocating movement of a member 402] the 1st piston in this housing 401.

[0050] Moreover, 403a and 403b are diaphrams which support a member 402 possible [movement (variation rate)] the 1st piston, and diaphram 403b forms the closed space 405 where compressible fluid (this operation form air) was enclosed with a member 404 and housing 401 the 2nd piston. Moreover, on both sides of the member 402, the coil spring 406 is arranged in a closed space 405 and the opposite side the 1st piston, and the elastic member which the compressible fluid enclosed with this coil spring 406 and closed space 405 connects with a member 402 the 1st piston, and carries out elastic deformation with the variation rate of a member 402 the 1st piston is constituted.

[0051] In addition, the following, especially when [as long as there is no notice] writing it as an elastic member 409, it is a meaning containing the false spring (air spring) formed of the compressible fluid enclosed with a closed space 405 as well as the coil spring 406. Incidentally, the 2nd piston, a member 404 can also be displaced in this direction of a member 402 the 1st piston, and the coil spring 407 which makes the elastic force of the sense to which the volume of a closed space 405 is made to reduce act on the 2nd piston 404 is arranged in the opposite side of a closed space 405 on both sides of the member 404 the 2nd piston.

[0052] Moreover, the hydraulic oil is enclosed, while it is open for free passage in the back room 251 of a piston 250 through piping, as the space 408 in which the coil spring 407 was arranged is shown in drawing 16 . the inside of drawing 17 and 410 -- the elastic force of a coil spring 406 -- opposing -- the 1st piston -- a member -- it is the piston control section changed to the case where a member 402 is held in a predetermined position, and the case where displacement of a member 402 is enabled the 1st piston (free state) [by the way,]

[0053] and the piston control section 410 will be in the state (state where elastic energy was stored in the elastic member 409) where the coil spring 406 contracted, in an initial state (state which assembled the actuator 400) -- as -- the 1st piston -- a member -- the member 402 is held In addition, this piston control section 410 has the coil spring (elastic member) which makes the plunger 412 which moves with the electromagnetic force by which induction is carried out with a solenoid coil (it abbreviates to a coil hereafter.) 411, and a coil 411 (variation rate), and the elastic force which opposes electromagnetic force act on a plunger 412, and is constituted.

[0054] Next, the operation of this operation gestalt is described. In the initial state, as shown in drawing 16 and 17, the member 404 is located in a member 402 side the 1st PISUTO the 2nd piston, and the volume of the exoergic room 260 of the screw dregs heater 200 is expanded. And when making the volume of the exoergic room 260 reduce, it energizes in a coil 411 and changes into the state where the variation rate of the plunger 412 can be carried out, and a member 402 can displace it the 1st piston.

[0055] Thereby, with the elastic energy stored in the coil spring 406, since a member 402 displaces the 1st piston, as shown in drawing 18 , the pressure in a closed space 405 rises, a member 404 and a piston 250 displace the 2nd piston, and the volume of the exoergic room 260 contracts. When [at which the sense of the variation rate of a member 402 is / in / that displacement of a member 402 is possible (free displacement is possible) and the state where it has become] reversed the 1st piston /

operating the piston control section 410 so that a member 402 may be held the 1st piston in the position where the elastic force of an elastic member 409 becomes large from the position which the sense of the variation rate of a member 402 reverses the 1st piston at this time, a plunger 412 is projected, and At this time, a plunger 412 and since the taper sections 412a and 402a are formed the 1st piston as shown in the contact sections of each of a member 402 at drawing 19 , a member 402 is held the 1st piston from the position which the sense of the variation rate of a member 402 reverses the 1st piston in the position where the elastic force of an elastic member 409 becomes large.

[0056] In addition, in making it expand from the state where the volume of the exoergic room 260 contracted, it operates the piston control section 410 like the case where it is made to reduce from the state where the volume of the exoergic room 260 was expanded. Therefore, the calorific value of a piston 250 (screw dregs heater 200) can be controlled, without controlling a valve system 120 like an above-mentioned operation gestalt.

[0057] Next, the feature of this operation gestalt is described. Since the elastic force of an elastic member 409 is held from the position which the sense of the variation rate of a member 402 reverses the 1st piston in the position which becomes large, when a member 402 displaces the 1st piston, where the elastic energy of the lost elastic member 409 is filled up, it will be again stored in an elastic member 409. Therefore, an actuator 400 can be worked by supplying the lost energy to an actuator 400.

[0058] (Other operation gestalten) Although the magnetomotive force of a coil 101 was changed by changing the applied voltage to a coil 101 with the above-mentioned operation gestalt, you may change the magnetomotive force of a coil 101 by constituting a coil 101 from two or more coils 101a and 101b, and changing the number of the coils to energize.

[0059] moreover -- the 4th operation gestalt -- expansion and contraction -- although the coil spring was used as a member 153, the 4th operation gestalt is not limited to this and is good also as a member which can expand and contract others, such as bellows

---

[Translation done.]